

# REPORT DOCUMENTATION PAGE

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1. REPORT DATE (DD-MM-YYYY)		2. REPORT TYPE Technical Papers		3. DATES COVERED (From - To)	
<div style="border: 1px solid black; border-radius: 50%; padding: 20px; text-align: center;"> <p>Please see attached</p> </div>				5a. CONTRACT NUMBER	
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a. REPORT	b. ABSTRACT	c. THIS PAGE	<div style="border: 1px solid black; border-radius: 50%; padding: 10px; display: inline-block;"> <p>A</p> </div>		Leilani Richardson
Unclassified	Unclassified	Unclassified			19b. TELEPHONE NUMBER (include area code) (661) 275-5015

MEMORANDUM FOR PRS (In-House Publication)

FROM: PROI (STINFO)

12 Sep 2001

SUBJECT: Authorization for Release of Technical Information, Control Number: **AFRL-PR-ED-AB-2001-187**  
Mario Fajardo et al., "Aluminum Doped Parahydrogen Solids" (Abstract only)

**HEDM Conference**  
(Mtg. Location/Date: TBD)

(Deadline: ASAP)

(Statement A)

1. This request has been reviewed by the Foreign Disclosure Office for: a.) appropriateness of distribution statement, b.) military/national critical technology, c.) export controls or distribution restrictions, d.) appropriateness for release to a foreign nation, and e.) technical sensitivity and/or economic sensitivity.

Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Signature \_\_\_\_\_ Date \_\_\_\_\_

2. This request has been reviewed by the Public Affairs Office for: a.) appropriateness for public release and/or b) possible higher headquarters review.

Comments: \_\_\_\_\_  
\_\_\_\_\_  
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Signature \_\_\_\_\_ Date \_\_\_\_\_

3. This request has been reviewed by the STINFO for: a.) changes if approved as amended, b) appropriateness of references, if applicable; and c.) format and completion of meeting clearance form if required

Comments: \_\_\_\_\_  
\_\_\_\_\_  
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Signature \_\_\_\_\_ Date \_\_\_\_\_

4. This request has been reviewed by PR for: a.) technical accuracy, b.) appropriateness for audience, c.) appropriateness of distribution statement, d.) technical sensitivity and economic sensitivity, e.) military/national critical technology, and f.) data rights and patentability

Comments: \_\_\_\_\_  
\_\_\_\_\_

APPROVED/APPROVED AS AMENDED/DISAPPROVED

\_\_\_\_\_  
PHILIP A. KESSEL Date  
Technical Advisor  
Space and Missile Propulsion Division

Pls change this info when you receive it

## Aluminum Doped Parahydrogen Solids

Not approved last year?

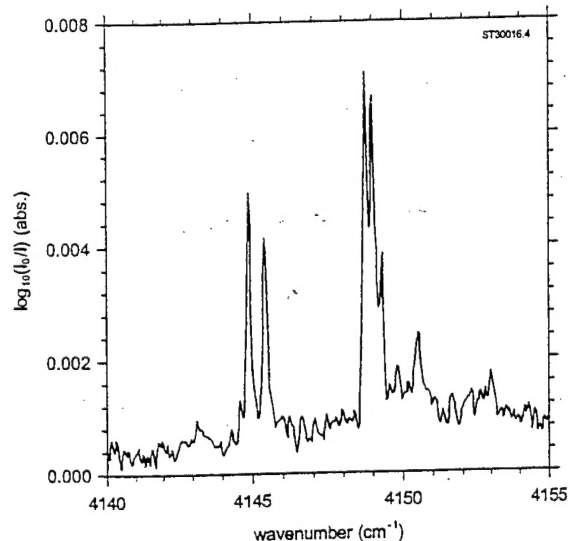
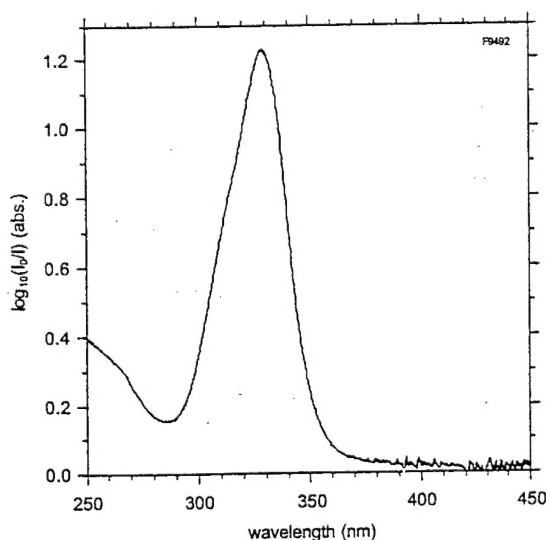
Mario E. Fajardo, Michelle E. DeRose, and Simon Tam

US Air Force Research Laboratory, Propulsion Directorate  
 (AFRL/PRSP Bldg. 8451, Edwards AFB, CA 93524-7680)  
 email: mario.fajardo@edwards.af.mil

During the past year we focused our efforts towards the production and characterization of gram-scale cryogenic parahydrogen ( $pH_2$ ) solids doped with large ( $\sim 1\%$ ) concentrations of Al atoms. We incorporated into our apparatus a commercially available effusive Al atom source capable of delivering Al atom fluxes in excess of  $10^{17} \text{ \#}/\text{cm}^2\text{-s}$  to the sample deposition substrate, enabling the deposition of heavily-doped millimeters-thick samples on a  $\sim 1$  hour timescale.

Pls use "an" for "an approximate hour"

Determination of the trapped Al atom concentrations from the measured ultraviolet (UV) atomic absorption spectra is problematic in such large column density (concentration  $\times$  pathlength) samples, due to limitations on the dynamic range and signal-to-noise ratio achievable in absorption measurements. Fortunately, we can exploit the weak infrared (IR) activity induced by the Al atom dopants in neighboring  $pH_2$  molecules as a diagnostic of the atomic concentrations. The left panel of the figure shows the UV absorption spectrum of a 1.4 mm-thick  $pH_2$  solid containing  $\approx 20$  ppm Al atoms; the right panel shows the corresponding Al atom induced IR absorption.



Our initial attempts to produce millimeters-thick samples containing Al atom concentrations in excess of  $\sim 500$  ppm have resulted in the apparent recombination and/or reaction of most of the Al atoms. We conjecture that when the  $pH_2$  solid reaches a critical combination of Al concentration and sample thickness, the energy released upon occasional atomic recombination is no longer dissipated effectively, resulting in increased local temperatures and atomic mobilities, and ultimately leading to a recombination cascade which propagates throughout the sample. Our efforts to achieve higher Al atom concentrations in thinner samples are ongoing; we will report our progress at the conference.

\* figured the plot's release; distribution intended.

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 statement  
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